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U.K. Research Funding

Universities grapple
with tighter budgets
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News Focus

Establishment of lobbying group called Save British Science points up concern of U.K. scientists over declining level of government support for research. **Page 7**

U.K. Scientists Fret over Slide in Funding for University Research

Declining level of government support for research has provoked concern over the impact on British science and scientists' morale, triggered formation of lobbying group called Save British Science

Dermot A. O'Sullivan, C&EN London

In a January issue of the *London Times* readers were confronted with an impressive looking half-page advertisement with the banner headline, "Save British Science."

The ad read in part, "British science is in crisis. Opportunities are missed, scientists emigrate, whole areas of research are in jeopardy. Government's support for research is declining, falling behind that of our main industrial competitors in Europe. There is no excuse. We can and must afford basic research, Britain's investment for the future."

Run by the Save British Science (SBS) group, the ad was generated by concern on the part of U.K. scientists about the declining level of governmental financial support. "We face the government's predominant policy to curtail public spending. And since science funding is part of public spending, it, too, is being kept down," explains John Mulvey, a particle physicist at Oxford University, and one of the founders of the group.

The reason for the scientists' discontent is what they see as the declining pattern of the government's spending on civil research over the past decade or so in relation to the country's gross domestic product (GDP), or total wealth, and the likelihood that this pattern will continue. For instance, during 1984-85 (the government's accounting year runs from April through March), the science budget of the Advisory Board for the Research Councils totaled \$691 million—based on \$1.00 = £0.796, the average value for the period April 1984 through March 1985. (This value is used throughout for direct year-to-year comparisons.) That was a mere 0.17% of the country's GDP, essentially unchanged during the previous 10 years.

In absolute "money of the day" terms, the 1984-85 budget was 350% more than it was 10 years earlier, and represented a 13.3% yearly rise. When the figures are corrected for inflation, on the other hand, the overall

increase is less than 8%, and the per-year growth averages 0.76%.

How these figures relate to the spending on civil research in other countries must be treated with some caution. For one thing, definitions of expenditure or the source of funding don't precisely match from one to another. However, the London-based Committee of Vice-Chancellors & Principals (CVCP) of universities makes the point, "Civil R&D, both inside and outside the universities, has been running at only 1.6% of the GDP in Britain. This compares with 2% in the U.S., and 2.5% in West Germany and Japan."

Save British Science developed out of discussions Mulvey had with several colleagues last fall. "It stemmed from realization that the problem is broader than our own individual ones," he recalls. "It became clear that there was need for scientists in all disciplines to come together and present their point if there is to be any improvement in the situation. Until now, there has been no coherent case put to government for the support of civilian science."

Rise in U.K.'s science R&D support budget outpaced by astronomy, engineering

\$ Millions	1984-85 ^a	Per cent	1983-84 ^a	Per cent	% change
Astronomy, space & radio	\$ 59.33	17%	\$ 51.10	16%	16%
Engineering	90.74	26	76.65	24	18
Nuclear physics	76.78	22	70.26	22	9
Science	94.23	27	86.23	27	9
Centrally supported activities	13.96	4	22.36	7	-38
Administration	13.96	4	12.77	4	9
TOTAL	\$349.00	100%	\$319.37	100%	9%

^a Fiscal year April 1 through March 31. Note: Conversion rate of \$1.00 = £0.796, the average value for the period April 1984 through March 1985 used for both years. Source: U.K. Science & Engineering Research Council



Mulvey: need to do more to overcome antiscience feeling

Encouraged by the response to a spot check of other scientists throughout the country, a committee was set up with Joseph Lamb, professor of physiology at St. Andrew's University in Scotland, as chairman, and Jeremy Leggett of the geology department at London's Imperial College of Science & Technology as treasurer. Others who have since joined the committee span the sciences from anatomy, animal behavior, and astronomy, to psychology and theoretical physics.

Members of Parliament interested in the state of scientific research in the U.K. have applauded the initiative. And CVCP says, "We welcome the campaign launched by many distinguished scientists to draw public attention to the crisis in the funding of scientific research."

Since its launching in December, the number associ-

ated with SBS has swelled to about 1800, eight of them Nobel Laureates. Voluntary contributions now total about \$23,000. Some of the money has come from the general public.

There is no set dues structure, but the fact that each individual has made a donation out of his or her pocket, according to Mulvey, is an indication of the depth of feeling on the issue, and the desire to see something done about it. "Scientists, especially the younger ones, are saying, 'We now have a channel for demonstrating our concern.' That has been an encouraging outcome of the campaign so far," he notes.

He readily acknowledges that SBS is a lobbying group, which, he points out, is unusual for British scientists to be involved in. "They wouldn't be driven to this atypical, and some might consider undignified, action unless there were a serious driving need," he adds.

"Much of the trouble that science in the U.K. is in right now stems from the fact that we as scientists have paid too little attention to the very serious and very difficult problem of communicating to the population generally just what science entails," he believes. "There is much antiscience feeling about, and we haven't done enough to overcome it. Nor have we taken the trouble of talking to our members of Parliament on the subject."

"It's true that most other countries appear to see the need to put a real increase into their science budgets," says Brian Fender, vice chancellor of Keel University, a former nuclear physicist, and chairman of the Science & Research Engineering Council. "That is not evident in this country. The problem in Britain is that as well as the contraction in funding by the government's University Grants Committee (UGC), there is no more than level funding from the research councils' side."

"I suppose the government is entitled to say that we must demonstrate our case more strongly. And to some extent Save British Science, quite rightly, is trying to achieve political pressure on the government to alter its policy."

For British scientists—chemists in particular—the situation is the more frustrating considering that Prime Minister Margaret Thatcher has a B.S. degree in chemistry, worked in the industry, and at one time headed the government's department of education and science. When the Conservative Party she heads was returned to power in 1979, the general assumption was that she would have a more understanding attitude of the needs of science.

Sir Robin Nicholson, chief executive of Pilkington's electro-optical division, sympathizes with this view of Thatcher. But he insists that Thatcher demands background briefing on the scientific implications of the many and varied issues that she and her Cabinet must decide on "to a degree greater than any of her predecessors."

He speaks from firsthand experience. Before he joined Pilkington in January, he was the British government's top scientist, serving four years as chief scientific adviser in the Cabinet office, which in Britain, he notes, is a nonpolitical appointment.



Fender: trying to put political pressure on government



Nicholson (left): provided scientific advice. Ashworth (center): academic freedom alive and well. Wilkinson: morale not very high

"I was continually called on to provide her detailed scientific advice on a wide range of topics," he recalls. Although she is not oblivious to the importance of science and its needs, Thatcher and her Conservative Party were voted twice into power on a manifesto to cut public spending and bring down inflation, which she has done, Nicholson points out.

Nonmilitary scientific research in the U.K. is funded almost completely by the government through what is known as the dual support system. One arm of this is UGC. The other comprises the research councils of which there are five: Agricultural & Food Research Council (AFRC), Economic & Social Research Council (ESRC), Medical Research Council (MRC), Natural Environment Research Council (NERC), and Science & Engineering Research Council (SERC). SERC provides the bulk of the funding for the core sciences—biology, chemistry, physics, and the like—although some money for research in these areas comes also from AFRC, MRC, and NERC.

Money from UGC goes toward the upkeep and running of the 50 or so universities and 30 polytechnic colleges throughout the U.K. Part of it is channeled to the science departments. The actual amount isn't easy to assess accurately because each institution makes its own decision on how to apportion its funds. However, as a general rule, it is more or less in line with that coming through the research councils. For example, during 1984-85, the UGC outlay totaled \$1.59 billion. From this, an estimated \$711 million (45%) went to provide the basis for research capability in the science departments.

In its December statement, "The Future of the Universities," CVCP emphasizes, "The UGC element of the dual system, the general recurrent and equipment grant, has declined since the mid-1970s, dramatically so in the 1980s. UGC itself has pointed out that the value of the equipment grant fell over 30% in the 1970s, and has continued to fall since, and that some [\$477

million] would be required to restore its value." Nevertheless, in a further drive to economize, UGC funding in the coming three years is geared to grow at a rate 2% less than the prevailing rate of inflation.

By comparison, the research councils' spending totaled \$664 million. SERC made up the largest share (\$349 million), followed by MRC (\$147 million), NERC (\$82 million), AFRC (\$58 million), and ESRC (\$28 million).

Some universities have taken positive steps to overcome the severe cuts in their budgets of a few years back. An example is what has happened at Salford University, near Manchester, which saw its recurrent grant sliced 44% in 1981. There, a commercial offshoot has been formed, Salford University Industrial Center. Wholly owned by the university, SUIC was revitalized by John M. Ashworth, a former biochemist who became vice chancellor when he stepped down as chief scientific adviser in the Cabinet office the same year.

Some consulting work already was being undertaken at Salford at the time, but sales were only \$600,000 or so a year, he recalls, "too small to be useful, but big enough to be distracting. So I decided that we must either shut it down or make it bigger. I brought in professional management, gave the center the objective of maximizing profits, and geared it into a growth mode."

SUIC now has a staff of about 50 (they are not on the university's payroll), and income has increased 10-fold. "Many of the contracts are short term and don't involve academics," he notes, "but for major undertakings there are mixed teams of SUIC employees and academics, mostly from the science and engineering departments." SUIC, and the new satellite companies going in, has access to the university's specialized equipment and services.

"I am trying to show that it is perfectly legitimate for a university academic to be interested in things

downstream from the traditional research as it is known in British universities," Ashworth says. "There is a further positive benefit. Involvement in such activities is reflected back into the teaching of undergraduates. Chemists that come out of our university have their feet on the ground."

No less important, of course, is that SUIC is an important source of revenue for the university. Last year it provided some \$400,000, which was reinvested. "Indeed, we are dependent on SUIC," Ashworth admits. "If the projects weren't profitable, the university's finances would have a real hole in them."

Ironically, he now is worried that the university funding will rise higher than the current 40% coming from industry. "My problem is to stop it there. Nobody knows what an institution would be like that gets most of its money from noneducational means. I would then be akin to being managing director of the University of Salford Inc., a subsidiary of which happens to be in education and training. We should not stumble into that situation without thought."

Ashworth insists that he remains an academic at heart. "It's quite proper for people who wish to do so to continue doing fundamental research. Academic freedom is alive and well at the University of Salford. But the research has to be the best. There is no point in doing second-rate fundamental research." For such people, he reasons, being engaged in research that is more at the applied end of science and engineering "is every bit as important," he adds.

In light of the government funding cutbacks, it's not surprising that chemistry departments aren't the happiest of places to be working these days in the U.K. The funding squeeze is affecting their running and the level of research conducted there.

"Morale is not very high," admits Sir Geoffrey Wilkinson, who heads the chemistry department at London's prestigious Imperial College of Science & Technology. An inorganic chemist of international renown and winner of the 1973 Nobel Prize in Chemistry (which he shared with West Germany's Ernst O. Fischer) for work on organometallic sandwich compounds, he is concerned about the low number of junior positions available for postdoctoral research.

"If more such positions were available, it would give young aspiring research chemists who wished to pursue a university career something to look forward to," he says. "But there is no wild enthusiasm for academic life because prospects don't look bright."

Despite a downward shift in the number of undergraduate chemistry students, there is no evidence as yet of a dropoff in the numbers going on for a Ph.D. Indeed, this year at Imperial College, 138 students are working toward their doctorate—the largest number ever, Wilkinson notes. Those with Ph.D.s for the most part leave to take jobs in industry.

"A new Ph.D. here usually starts work in industry at a salary of about \$15,000," he points out. That's more attractive than the \$10,000 or so the person could expect from an academic postdoctoral post, he admits. "So anybody who gets a Ph.D. and is offered a job in industry is well advised to take it," he says.

"My research budget has been going up about 2% a year. Taking inflation into account, I have been falling behind. And this is on top of a direct cut of 30% in the departmental budget about three years ago. All postdoctoral positions had to be sacrificed."

Wilkinson also cites the \$817 or so annually that SERC provides for each research training support grant as being inadequate. "It costs us about \$2500 a year to keep a person at the bench for synthesis work. So every new person who works here on such a grant is a further drain on our budget. One way we are trying to cope is by replacing expensive experiments at the undergraduate level with cheaper ones."

His 1985 chemistry department budget was \$1.6 million. About 82% of that went for salaries. From the remainder, the running of teaching labs and of the departmental instruments, as well as the cost of general administrative services, the library, and workshops had to be funded. That left \$94,000 or so split among inorganic, organic, and physical chemistry to pay for materials needed in research.

Seeking funding for purchasing new equipment has its own set of problems. For the more sophisticated items, SERC requires a contribution of about 30% from the university's budget.

"It's clear to all that some areas of science, chemistry among them, are being whittled away in the U.K.," Wilkinson maintains. "Support for chemistry comes to about 8% of the total SERC annual budget despite the importance of chemistry to the U.K. economy."

The comments of Jack E. Baldwin, professor of organic chemistry at Oxford University and an authority on the structure and synthesis of penicillins, mirror those of Sir Geoffrey. "What is happening is that the morale here in the U.K. is so bad that it is damaging," Baldwin says. "We don't have adequate equipment levels, we can't get money easily to do our research. The whole thing is sliding downhill."

"The way it's going now, I think it's destroying the science of chemistry in this country," he says bluntly. "Unless SERC and the government abruptly change their policy, we will be in a position where not only do we have a second-rate university system, but worse and much more important we will have a second-rate industrial chemical system. And the chemical industry in this country is about the best industry we've got. It's making money. If they throw that out the window, what will we have after the year 2000? It's very, very foolish."

Baldwin acknowledges that there is some financial support for university chemistry departments through the Cooperative Awards for Science & Engineering (CASE) scheme set up a few years ago to increase interaction between universities and industry. "There's a good argument for part of it. But the projects tend to be biased along company lines. In some respects it has worked against us, because companies can claim they are supporting universities through CASE rather than by direct grants."

Baldwin gets some funding for his research from pharmaceutical companies. But he insists on freedom to publish his results after a delay of three months

when the company has had an opportunity of evaluating them.

Not one to mince words, Baldwin has some radical views on the U.K.'s system of higher education. "One of the problems in this country is that we've got too many departments of chemistry. There are more than 80 establishments that give Ph.D. degrees in chemistry. There is no way that we can support more than 25 engaged in first-rate research. We should invest our resources where we can get the most return for them. And that isn't by spreading them in a thin layer throughout the U.K."

Speaking from his experience of working in the U.S., where he was on the chemistry faculty at Pennsylvania State University for three years followed by eight years as chemistry professor at MIT, he also believes that U.K. university staff members should be paid in accordance with their achievements. "Here, all salaries are fixed. There's no flexibility. You can't encourage good people by giving them raises, or discourage weaker ones by reducing their pay."

"The most important change that could occur in British universities is to have very substantial differential salaries, as is the case in the U.S.," he maintains. "Geoffrey Wilkinson won a Nobel Prize, but he doesn't get any more money. He got a knighthood."

He decries the fact that so much of the funding coming from SERC goes toward costly experiments in astronomy, nuclear physics, and the like, noting the mere \$9 million that goes directly to university chemistry departments out of the total expenditure of \$349 million during 1984-85. "No high-energy physics experiment has any commercial possibility, whereas it's quite likely that some chemists will make very important discoveries that will have all sorts of commercial potential."

In a rebuttal to this line of thinking, SBS's John Mulvey points out, "This is an argument that's a lot older than the past three years. If you look back over

the history of science, you will always find incidents of one branch of science attacking another. But it's a very dangerous path to enter. We should recognize the unity of science. A lot of what chemists are doing today wouldn't be possible if physicists hadn't been 'wasting their time' doing their research 20 or so years ago."

Sir David Phillips, professor of molecular biophysics at Oxford, who serves as chairman of the Advisory Board for the Research Councils (ABRC), also points to the fact that expensive equipment such as that at the Rutherford Appleton Laboratory near Oxford, with its new spallation neutron source, is for use by scientists generally. Among them, chemists form a large proportion, he says.

He concurs that "chemistry, like everything else, has become much more capital intensive than it used to be. One can't do frontier-type research without such tools as NMR and mass spectroscopy. But to suppose that these tools can be distributed throughout all the labs in the country that are doing chemistry seems to me to be a nonstarter."

Phillips and his ABRC colleagues have the difficult task of apportioning the funds coming through the department of education and science. Of the \$691 million spent in 1984-85, 50.5% (\$349 million) went to SERC, 21.3% (\$147 million) to MRC, 11.9% (\$82 million) to NERC, 8.4% (\$58 million) to AFRC, and 4% (\$28 million) to ESRC. Some of the \$27 million balance went to the British Museum of Natural History and the Royal Society.

Faced with the prospect of cash shortages for research funding in the immediate future, ABRC got welcome relief late last year when the government decided to inject an additional \$19 million annually into ABRC's budget during the coming three years. In 1986-87, the cash grant now will be \$771 million, 5% over the current year. For the two years following, there will be a rise of some 2.5% a year to \$789 million in 1987 and \$809 million in 1988.



Baldwin (above): sliding down hill.
Phillips (center): will lose ground.
Reece: viability of universities is key



"Although it is less than we recommended was needed, it will make a valuable contribution to sustaining the science base," Phillips told Sir Keith Joseph, Minister of Education & Science. But as one scientist points out somewhat cynically, "The government made a big present of the \$44 million. But it won't correct for inflation over the time span. So funding still is set to go down in real terms. If there is a science policy, it is a policy of decline. One can't plan ahead under those circumstances. One doesn't know what is ahead."

Phillips observes that U.K. industry's contribution to the country's civil R&D funding is about 40% of the total. "If government's contribution were held constant and industry's increased to 60% of the total rather than 40%, I believe we would compare quite well with what other countries are spending."

"What worries me is that industry won't change its attitude all that quickly. And if government insists that it is doing all it can, then we will continue at a disadvantage and lose ground over an interim period of undefined length. That would be very dangerous in my view. Somehow I hope that government will fill the gap while industry's attitude is evolving."

Charles H. Reece, Imperial Chemical Industries' director of research and technology, acknowledges that "morale of the scientific community at U.K. universities has been badly dented. The reason," he explains, "is that everything is being done in such a short time frame. Universities used to function on a five-year rolling basis. Now they don't know where they are from one year to the next."

For ICI, the continuing viability of Britain's universities is of key significance. "About 70% of our science is done here," he notes. "Although that might change a little, it won't change by much. The U.K. will be our main kernel of scientific knowledge for quite a number of years, if not forever. So it is important that we have a healthy university scientific community."

"What industry wants from universities is not inventions. We can invent better than they can. We look to U.K. universities to provide well-trained scientists of sufficient excellence to be on equal terms with other international bodies of researchers, and familiar with all the modern techniques to bring to bear on a problem."

He cites a number of ways that his company contributes to ensure that this is so. ICI gives nearly \$4 million or so a year to U.K. universities in one form or another. For example, upward of 300 Ph.D. students work part time at ICI labs, part time at universities, and some 70 of its staff members teach at the professorial level. Also, a number of ICI people play an active part on various SERC committees.

The company spends about \$628,000 annually on selective lines of research at 25 universities in the U.K., two in Belgium, one in France, and at Massachusetts Institute of Technology and the University of Texas. "I would like the figure to go to about \$942,000," Reece says. "We have more projects to consider than we have funds to cover them. All this is done at the postdoc level."

About 10 projects chosen annually continue for a three-year term. Areas of study are diverse, and not necessarily of immediate potential commercial interest to ICI. They range from x-ray crystallography of proteins to polypeptides, biomaterials, molecular biology, and solid-state physics.

Of course, ICI isn't alone among U.K. companies promoting scientific research at the universities. A number are involved to varying degrees. For instance, British Petroleum set up what it calls its Blue Skies program six years ago. Working with a budget of some \$2 million a year, Don Braben, who heads the program at BP's London headquarters, currently supports 22 projects, many of them esoteric, at academic institutions mostly in the U.K. "We look for research of the type that may lead to innovation, and back individuals or small groups who need freedom to develop their ideas fully," he says.

Observes John L. Cadogan, BP's research director, past president of the Royal Society of Chemistry, and until recently chairman of SERC's science board, "The \$9 million or so a year that SERC spends on research grants each in physics and chemistry simply is too small. More needs to be earmarked in the core sciences. Our ambitions in BP are to strengthen contacts between universities and industry."

Despite the spirit of gloom and doom among U.K. scientists, Keel University's Brian Fender, who succeeded Cadogan on the science board this year, sees a good side to the current situation. "There is a great deal more collaborative research going on now," he says. "Scientists recognize the virtues of getting together to tackle problems collaboratively. Very often this is interdisciplinary. Biologists and chemists may pull in the physicists to work alongside them. Another good feature is the increasing tendency to build into research projects involvement from industry."

He is very optimistic about the outcome of what he calls the theme approach he and his science board are pushing. Many of these themes have subthemes, and some of them can become research initiatives, he observes. Within the neurobiology and cognitive science theme, for instance, are the subthemes of neurochemistry, signaling and transmission, sensory and motor systems, cognition and artificial intelligence, and the like.

Research initiatives already are under way in such areas as low-dimensional structures, sensors and protein engineering, image interpretation, and invertebrate neuroscience. Being considered are catalysis and interfaces, molecular recognition and biological specificity, molecular electronics, inorganic nutrients, drugs and poisons, and molecular biology of membrane processes.

"One of the things we are trying to do at SERC is build bridges between disciplines," Fender adds. "It is an interesting fact that of the engineering funding by SERC, 17% goes to science departments. Just as one seeks to break down, where it's appropriate, the boundaries between physics and chemistry, or chemistry and biology, one should want to do it also between science and engineering." □